



# Invasive and Exotic Plant Management in Sitka National Historical Park

## *2011 Summary Report*

Natural Resource Data Series NPS/SITK/NRDS—2011/225



**ON THE COVER**

View of Mt. Kincaid from the coastline of Sitka National Historical Park.

Photograph by: Matt Goff, Sitka, AK

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# **Invasive and Exotic Plant Management in Sitka National Historical Park**

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Natural Resource Data Series NPS/SITK/NRDS—2011/225

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## Abstract

This report describes the work performed by the Alaska Exotic Plant Management Team at Sitka National Historical Park during the 2011 field season. The 2011 Sitka Exotic Plant Management Team staff was comprised by a single Student Conservation Association intern. For the eighth consecutive year, invasive plant inventories were conducted throughout the 113 acre park, as well as in surrounding areas. Invasive plant populations were mapped using a Trimble Pro XRS with a Ranger data-logger. Data was edited and analyzed using Pathfinder Office and ArcGIS. Control work was conducted primarily in the Russian Memorial and Visitor Center areas by a Southeast Alaska Guidance Association crew. Overall, 15.1 acres were surveyed and 1.2 acres were manually controlled; 1,544 pounds of invasive plants were removed from within the park. Special effort was dedicated to the inventory of European mountain-ash (*Sorbus aucuparia*) throughout Sitka in order to develop future management plans.

## Acknowledgments

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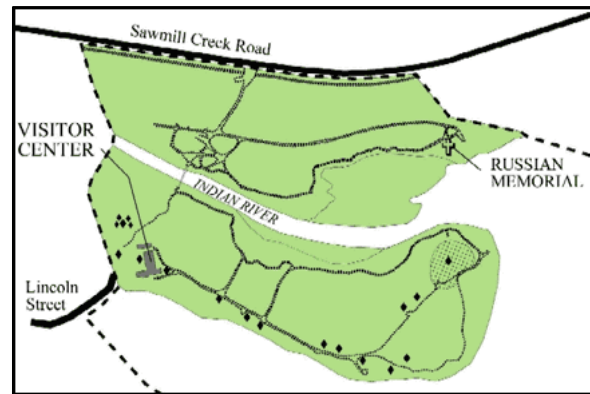
## Abbreviations

|      |                                       |
|------|---------------------------------------|
| EPMT | Exotic Plant Management Team          |
| GIS  | Geographic Information Systems        |
| NPS  | National Park Service                 |
| SAGA | Southeast Alaska Guidance Association |
| SITK | Sitka National Historical Park        |

# Introduction

The control of invasive, non-native plants is of increasing concern in ecosystem management across the world (Pimentel 2002). The invasion of non-natives into intact ecosystems is recognized by scientists and land managers as one of the primary causes of biodiversity loss, ranking second only to outright habitat loss (Pimm and Gilpin 1989, U.S. Congress 1993, Myers 1997, Stein et al. 2000). More than just the native biodiversity is threatened, however; the introduction of invasive non-natives threatens community structure and composition and ecosystem processes (Cronk and Fuller 1995, Walker and Smith 1997, Cox 1999). Not all non-native species are equally harmful. Most non-native species that are introduced are poorly adapted to their new environments and are unable to establish viable populations. Of those that can establish, only a small subset proceeds to invade native ecosystems. Establishment is highly dependent on ecological and climatic conditions (Taylor and Hastings 2005).

Sitka National Historical Park (SITK) was established in 1910 to preserve historically and culturally significant sites and artifacts related to the 1804 Battle of Sitka between the Tlingit Indians and the Russians, the Russian-American period in Alaska, and the Native people of southeastern Alaska (Figure 1). The park is located on the western coast of mountainous Baranof Island at the mouth of the Indian River, an important regional salmon stream. The Indian River drains a narrow post-glacial valley delineated by rugged coastal peaks. Sitka has a maritime climate characterized by relatively heavy precipitation with moderate temperatures ranging from an average daily low of 31 degrees Fahrenheit in January to an average daily high of 55 degrees in July and August (Lipkin 2005).



**Figure 1.** Map of Sitka National Historical Park.

Though relatively small at only 113 acres, SITK contains a variety of habitat types including temperate rainforest, open meadow, estuary, the mouth of a river that is anadromous fish spawning habitat, and semi-temperate rainforest typical of southeastern Alaska and is characterized by the Sitka spruce/western hemlock closed-canopy forest type. The northern portion of the park exhibits old-growth characteristics such as multiple canopy layers, trees of varying diameters, snags, and downed woody debris. Non-forested areas in the park include the Indian River estuary and associated wetlands, the beach fringe (a shrub zone between the intertidal zone and forest edge) and the historic Tlingit fort site, which is a maintained grassy opening enclosed by the surrounding forest. The maritime intertidal area is unusually diverse and productive (Lipkin 2005).

Due to relative isolation and limited transportation into the region, few invasive species have been established in SITK. In addition, many parklands in Alaska have remained relatively free of anthropogenic disturbances that encourage the introduction of invasive species, thus parks in Alaska still retain all of their major floral and faunal ecosystem components (Densmore et. al 2001). Despite these protective elements, the threat of invasive plant invasion is increasing due to factors including climate change, increases in construction-related disturbance, and tourism.

With increased ease of transportation more of these species have arrived and are now spreading throughout Southeast Alaska and the Interior. Throughout Alaska, over 170 non-native plant species have been documented, accounting for approximately 10% of the flora (AKEPIC 2005).

Since 2001, surveys for non-native plant species have been carried out on National Park Service (NPS) lands in Alaska. These surveys provide the baseline data used in formulating long-term monitoring and control plans for exotic plant species in Alaska NPS units. The Alaska Exotic Plant Management Team (EPMT) was founded in 2003 and has become a model early detection and rapid response program for Alaska and its National Parks. EPMT work has occurred in SITK annually since 2004. In previous years efforts have been focused on manual control work and limiting infestation sizes. While that effort continued this year, special focus was given to completing an intensive inventory of European mountain-ash (*Sorbus aucuparia*) within SITK. This information will be used to develop a management plan that may include eventual treatment with herbicide. Information on the status and number of exotic plant species in SITK will be used to help prioritize areas in the park and state for long-term monitoring and control of these species on Alaska NPS lands.

## Methods

2011 field work at SITK was conducted from May to August. The SITK EPMT consisted of SCA intern Amanda Wolfe. There were two weeks of assistance by Southeast Alaska Guidance Association (SAGA) AmeriCorps crews from July 11<sup>th</sup> to July 22<sup>nd</sup> (Figure 2). Data collection was conducted following the Alaska EPMT 2011 field protocol (Million and Rapp 2011). This included mapping areas where invasive species occurred, areas where no invasives were found, and areas that had been previously treated. Data was collected using a Trimble Pro XRS with a Ranger data logger using TerraSync 4.10 software. Areas with and without non-native species were inventoried at accuracies sufficient to allow for the inter-annual comparison of changes in invasive plant infestation sizes. Data were differentially corrected and edited using GPS Pathfinder Office version 4.20., then sent to the NPS regional office for export to a geographic information system (GIS). The Alaska EPMT data dictionary collects sufficient information for the data to be used in two different databases (Million and Rapp 2011); the Alien Plant Control and Management Database, which is the NPS database for invasive plant data, and the Alaska Exotic Plant Information Clearinghouse, which is used for tracking invasive plant infestations throughout Alaska. Manual control treatment methods included hand pulling or digging out plants. Vegetative material was placed into bags, weighed, and disposed of in the Sitka landfill.



**Figure 2.** SAGA crew member pulling creeping buttercup near the Russian Memorial Site.

Control areas were chosen by determining which species were the most threatening and the probability of success of treatments. These determinations were made using the Alaska Invasive Species rankings (Carlson et al. 2008). These rankings rate the relative threat a species poses to natural communities and gives them a value from one to one hundred, with higher numbered species being of the most concern. Small infestations of highly ranked species were treated because of the possibility of eradication from the park. Selected infestations of lower ranked species in the park were also treated to prevent them from spreading to uninfested areas of the park.



## Results & Discussion

### Species Summaries

The identification of multiple new invasive species, such as bitter dock (*Rumex obtusifolius*) and tall buttercup (*Ranunculus acris*), within SITK this year demonstrates the urgency of continued monitoring and control to protect the native plant communities. In the open areas including mowed lawns, common dandelion (*Taraxacum officinale* spp. *Officinale*), white clover (*Trifolium repens*), common plantain (*Plantago major*), creeping buttercup (*Ranunculus repens*), and mouse-ear chickweed (*Cerastium fontanum*) are ubiquitous. In shadier wooded areas, creeping buttercup and European mountain-ash (*Sorbus aucuparia*) are prevalent. Escaped ornamental garden plants in the western corner of the park and near the Visitor Center are another source of concern.

#### ***Shepherd's purse – Capsella bursa-pastoris***

Invasiveness Rank: 40

This species was first documented within SITK in 2010 (Auer and Link 2010). Four small infestations, totaling 0.015 acres, were found by the footbridge and at three locations along the river trail. No treatments occurred in 2010 (Auer and Link 2010). During the 2011 season these locations were monitored and no plants were found. This suggests a potential misidentification during the 2010 season. These locations should be closely monitored in coming years to either confirm or negate the presence of shepherd's purse within SITK.

#### ***Perennial cornflower – Centaurea montana***

Invasiveness Rank: 46

Since 2008 perennial cornflower has been identified and controlled in the area of the park known as Merrill Rock and along Lincoln Street. In 2011 all plants were removed along with as much of the root system as possible. Hand-pulling has proven to be effective, with infestation size decreasing in the past few years. In 2011, 0.0004 acres were detected versus 0.027 acres in 2009 and 0.001 acres in 2010 (Auer and Link 2010). Perennial cornflower is growing in private gardens located directly across the street from the park, so continued monitoring for this species will be required.

#### ***Mouse-ear chickweed – Cerastium fontanum***

Invasiveness Rank: 36

Mouse-ear chickweed is prevalent both inside and outside the park boundary. The species is most often found along open trails within SITK, and in open areas such as the Fort Site. Mouse-ear chickweed infestations seem limited to disturbed areas with sufficient available sunlight. This species is the third largest invasive infestation within SITK, at 1.245 acres. Controlling this species would be time consuming; however, it still may be feasible in certain circumstances. During the 2011 season a single isolated infestation in the northwest sector was hand-pulled.

***Snow-in-summer – Cerastium tomentosum***

Invasiveness Rank: N/A

Snow-in-summer (Figure 3) was first discovered growing between the rocks separating the coast from Lincoln Street in 2006. Growing in the same location, the infestation was only 0.000007 acres in 2011, and easily removed. In 2010, infestations of Snow-in-summer were mapped along Sawmill Creek Road just outside of the east park boundary (Auer and Link 2010). This species was not detected during follow-up monitoring in 2011. A common but less aggressive ornamental, it is unlikely that Snow-in-summer would have established in the Sawmill Creek Road area.



**Figure 3.** Snow-in-summer growing along Lincoln Street.

Mouse-ear chickweed is poorly suited to the shady, frequently mowed habitat available. This species also reproduces vegetatively and there are no signs of a probable propagation source nearby. This area, along with the coastal area on Lincoln Street, should continue to be monitored during successive seasons.

***Purple foxglove – Digitalis purpurea***

Invasiveness Rank: 51

A popular garden ornamental, purple foxglove is thriving in the greater Sitka area. Infestations of foxglove, totaling 0.00007 acres, were identified and removed within SITK in 2011 in the Visitor Center gardens and a former picnic area. Infestation size is limited and plants are easily removed. Continued monitoring should occur in subsequent years.

***Oxeye daisy – Leucanthemum vulgare***

Invasiveness Rank: 61

Oxeye daisy is a popular ornamental plant that is prevalent in local gardens, along roadsides, and in open areas. Oxeye daisy forms dense colonies that decrease overall plant species diversity. In 2011 this species was found in the Visitor Center gardens and in the courtyard behind the Visitor Center. Total infestation size within the park was determined to be 0.004 acres. All infestations were treated but continued monitoring is recommended to ensure the species does not become established in other locations, such as the Fort Site since it is an open area with suitable edge habitat.

***Yellow toadflax – Linaria vulgaris***

Invasiveness Rank: 69

Yellow toadflax was not found in the park in 2011. In 2006, the species was found outside the park in a parking lot of Sheldon Jackson College, although plants have not been observed at this location in subsequent years. The species is not likely to spread into the adjoining parkland since a dense, shade-producing forest canopy will probably preclude its establishment. It is possible, however, for seeds of this species to be transported by people or animals to habitats with more available light within SITK. Continued monitoring for this species should occur park-wide; once established it is difficult to remove.



**Apple – *Malus pumila***

Invasiveness Rank: not ranked

A single, domestic apple tree is growing in the vicinity of the Fort Site. Ring analysis of the tree suggests that the tree located there is from the World War II era. Its effect to the native ecosystem is inconsequential. It serves as a valuable cultural link to WWII; therefore, it is recommended that the tree be left undisturbed.

**Pineapple weed – *Matricaria discoidea***

Invasiveness Rank: 32

Pineapple weed (Figure 4) was previously identified and removed around the Visitor Center in earlier years. In 2007 it was discovered in the upper Visitor Center parking lot and near the Russian Memorial. In 2009 and 2010 this species was observed but in small populations. During the 2011 season infestations totaling 0.0002 acres were removed near the Visitor Center bathrooms and from the surrounding gardens and walkways. Combining its relatively low invasiveness ranking and its limited distribution, the threat of this species to the native flora of SITK is low, although continued monitoring should occur.



**Figure 4.** Pineapple weed growing near the Sitka National Historical Park Visitor Center.

**European Forget-Me-Not – *Myosotis scorpioides***

Invasiveness Rank: 54

Although the forget-me-not (*Myosotis alpestris* ssp. *asiatica*) is Alaska's state flower, it is rare to find it growing naturally in Southeast Alaska. In contrast, European forget-me-not (*Myosotis scorpioides*) is prevalent and frequently planted. Forget-me-nots were removed from the Merrill Rock area in 2010, but were not detected in 2011 (Auer and Link 2010). Populations located in the private garden across Lincoln Street should be monitored to prevent spread into SITK.

**Reed canarygrass – *Phalaris arundinacea***

Invasiveness Rank: 83

Most likely introduced via roadside revegetation, Sawmill Creek Road is the only known location of reed canarygrass near SITK. Despite its great potential to spread and displace native species, particularly in riparian habitats, the habitat available within the park boundary along Sawmill Creek Road is not suitable for the growth of reed canarygrass. Annual monitoring of the species should continue throughout SITK. If detected within the park boundary, the entire plant with root system should be removed since regrowth from rhizomes is probable.

**Common timothy – *Phleum pratense***

Invasiveness Rank: 54

Common timothy is currently restricted in its distribution to areas outside the park boundary since the removal of a small infestation in 2005 from the Totem Trail. It is common along the Sawmill Creek Road sidewalk, and therefore possible that seeds will be transported into the park by animals or people. Consequently, annual monitoring for this species should continue.

***Common plantain – Plantago major***

Invasiveness Rank: 44

Common plantain does well in highly disturbed habitats and rarely spreads into less disturbed areas. Removal is relatively easy, making it possible to manage smaller populations. Very little control of this species was done in previous years, resulting in approximately 0.486 infested acres within SITK. During the 2011 season removal occurred when present in conjunction with creeping buttercup management by SAGA crews.

***Japanese knotweed – Fallopia japonica***

Invasiveness Rank: 87

Since 2001, two locations near the footbridge and on the adjacent trail have been diligently controlled by SITK employees. Continued depletion of energy reserves in the root system over a series of years lead to its eradication, and in 2010 it was finally listed as “Not Detected” (Auer and Link 2010). It was also not detected within SITK during the 2011 season.

Since 2006, there have been two robust infestations of Japanese knotweed located on private property across from the Visitor Center and Merrill Rock area (Figure 5). During the 2011 season, SITK EPMT worked with these land owners to educate them on the threat posed to native plant species and how to effectively control the growth of Japanese knotweed. This area should be carefully monitored and future EPMT should continue education and outreach efforts in the community regarding this species.



**Figure 5.** Japanese knotweed on private property just outside of the SITK boundary.

***Sweet cherry–Prunus avium***

Invasiveness Rank: N/A

A single tree was found growing along the beach at the southern tip of the park in 2005. The tree should be monitored to determine if seedlings are spreading in the vicinity, however, none have been detected in subsequent years.

***Tall buttercup- Ranunculus acris***

Invasiveness Rank: 54

In 2010 questions were raised about the proper identification of buttercup species within the park (Auer and Link 2010). Possible hybridization was suggested as an identification challenge. In 2011 the presence of tall buttercup was confirmed with the aid of SITK Biologist, Craig Smith. However, creeping buttercup remains the dominant buttercup species with patches of tall buttercup often intermingled. Both species were removed in quantity from the park during the 2011 EPMT season by SAGA crews.

***Creeping buttercup – Ranunculus repens***

Invasiveness Rank: 54

Creeping buttercup has the most widespread distribution of all non-native species within the park, covering a combined 2.015 acres, in both open and shaded habitats. It is common along trails and in mowed lawn areas, and appears capable of displacing the native forest herbaceous understory, including deer heart (*Maianthemum dilatatum*), small-flowered buttercup (*R. uncinatus*), and large-leaved avens (*Geum macrophyllum*), in areas without disturbance. Areas with extensive slug herbivory on native species showed relatively little damage of creeping buttercup, suggesting this species may be unpalatable or possibly even toxic. Since no habitat in the park seems immune to creeping buttercup invasion, this is a priority control species. In 2011 removal efforts were focused on the Russian Memorial site and extending trailways, the Battle of 1804 site, and along the coast near the Visitor Center. In the future decisions regarding management of creeping buttercup should consider the extent of infestation, as well as the actual ecological impact of this species.

***Sitka rose – Rosa rugosa***

Invasiveness Rank: 72

Locally referred to as the Sitka rose, *Rosa rugosa* is native to China, Japan, and Korea and has been well documented to escape cultivation and efficiently naturalize. In 2006, the park strategically planted Sitka roses around Visitor Center sidewalks and gardens in order to limit foot traffic on the surrounding hills and lawns. In 2010 a single Sitka rose plant was discovered near the Battle of 1804 site information sign and removed (Auer and Link 2010). This plant was not detected in 2011, indicating successful eradication in that area. If the plantings around the Visitor Center continue to be maintained and not allowed to spread vegetatively, they are not likely to naturalize.

***Common sheep sorrel – Rumex acetosella***

Invasiveness Rank: 51

First identified in 2005, common sheep sorrel continues to pose a threat in the eastern corner of the park from the neighboring Arrowhead Trailer Park. A single patch was detected in 2011 in the Visitor Center upper parking lot garden. This patch was manually treated and the entire root mass and all rhizomes removed. Common sheep sorrel can be easily controlled within SITK if monitored and eradicated each summer.

***Curly dock - Rumex crispus***

Invasiveness Rank: 48

During the 2011 season curly dock was found in large quantities throughout all of the gardens surrounding the Visitor Center. This is the first year it was been recorded within the park boundary. Manual treatment was performed and all plants were removed. Care was taken to remove the entire root mass and all rhizomes. These areas should be monitored closely in subsequent seasons. The infestation is of a manageable size and can be eradicated with continued diligence by future EPMT efforts.

***Bitter dock –Rumex obtusifolius***

Invasiveness Rank: 48

Bitter dock was observed this season for the first time since the invasive plant inventory in 2000. Located in the courtyard area behind the Visitor Center, this species was found in the rosette

stage and all specimens were removed. The area is frequently mowed and the likelihood of a mature plant going to seed is low. However, regeneration is possible from taproot segments only 1 inch (2.5 cm) long. Care should be taken to remove the entire root mass. This is a difficult species to monitor as it interbreeds with other docks.

### ***Birdseye pearlwort – Sagina procumbens***

Invasiveness Rank: 39

This species was first seen growing in mowed lawn areas near the Visitor Center, Russian Bishop's House, and by Arrowhead Trailer Park in 2006. Birdseye pearlwort is often sold locally as ground cover and may have originally entered the park in such a way. In 2009 it was completely removed from the Visitor Center area (in the lower parking lot and the circular walkway in between the upper parking lot and main Visitor Center) but small infestations remained in the courtyard. In 2011, the infestations had increased slightly in size. Monitoring in these areas should continue although effective control is difficult due to the creeping nature of this species where it roots at its nodes.

### ***European mountain-ash – Sorbus aucuparia***

Invasiveness Rank: 59

European mountain-ash has been planted widely in Sitka in yards and along roadsides. Its prolific production of red berries, which are consumed by birds and redistributed, has resulted in hundreds of mountain-ash trees within SITK (Figure 6) ranging from small (< 0.5 m tall) seedlings to trees exceeding ten meters in height. Although European mountain-ash may hybridize with the native species, the mountain ashes in Sitka display characteristics of the non-native species (Table 1). Due to their adaptability and ability to displace other species, all seedlings should be removed when located, as done during the 2011 season. A European mountain-ash management plan is currently being developed to successfully manage mature trees incorporating manual and chemical treatment methods.



**Figure 6.** European mountain-ash growing in Sitka National Historical Park.

**Table 1.** Comparison of traits of native and non-native mountain-ash species.

|                          | <b>European Mountain-ash<br/><i>Sorbus aucuparia</i><br/>(non-native)</b>                       | <b>Sitka Mountain-ash<br/><i>Sorbus sitchensis</i><br/>(native)</b>  |
|--------------------------|---|--|
| Height                   | Small tree, 5-15 m  | Medium to tall shrub, 1-4 m  |
| Trunk/Stem               | Primarily single stem, grayish, branched  | Multi-stem, grayish-red, sparingly branched  |
| Winter buds/young growth | Grayish soft-hairy  | Somewhat rusty-hairy   |
| Leaves                   | 11 to 15 (17) leaflets, sharp pointed at the tip, mostly smooth, saw-toothed almost to the base | 7-11 leaflets, rounded to blunt at the tip, sometimes rusty-hairy below, coarsely saw-toothed for not more than ¾ their length |
| Flowers                  | Flat-topped; branches white-hairy; calyces hairy  | Half-rounded; branches rusty-hairy; calyces mostly smooth  |
| Fruits                   | Globe-shaped; not glaucous  | Globe-shaped to ellipsoid; glaucous  |
| Habitat                  | Cultivated, and escaped   | Woods, up into subalpine region  |

Klinkenberg 2004, Hulten 1968

***Common dandelion – Taraxacum officinale ssp. officinale***

Invasiveness Rank: 58

Common dandelions grow in sunny locations, including the mowed lawns near the Visitor Center, Russian Bishop's House, and Fort Site and along the shoreline, riverbanks (inclusive of the tidal meadows), Sawmill Creek Road and the Battle of 1804 site. Based on the density of plants and the level of continued disturbance, the focus of common dandelion control work should be along the coastline and riverbanks where human disturbance is minimal and native plant community structure is still intact. Areas with extensive human trampling will be more difficult to control over the long term, and the native plant community has already been affected. In 2006, 2007 and 2008, control work at the historic battle site focused on removing common dandelions from the coastal margin. In subsequent years, control work has shifted to higher-ranked and/or more successfully manageable plant species. Efforts should continue be made to remove the smaller infestations before they become too widespread.

***Red clover – Trifolium pratense***

Invasiveness Rank: 53

Thus far, red clover has been observed only outside the park along Sawmill Creek Road. Annual monitoring within SITK, particularly in more open areas, will ensure quick detection and rapid removal of this species if it ever crosses into the park. Small patches of red clover may be increasing along the edges of the park.

***White clover – Trifolium repens***

Invasiveness Rank: 59

White clover has successfully invaded most of the sunnier locations within and outside of the park. Many of the lawn areas in the park (Fort Site, Visitor Center and Russian Bishop House) have large infestations of white clover. Smaller infestations were pulled in 2010 (Russian Bishops House, Visitor Center picnic area) but a large, cohesive effort was not attempted due to focus on higher priority species (Auer and Link 2010). Similarly, in 2011, small areas along the shoreline and Visitor Center gardens were pulled, only when in conjunction with the removal of higher priority species. Due to the creeping nature of this species where it roots at its nodes, controlling it is particularly difficult. Efforts should continue be made to remove the smaller infestations before they become too widespread.

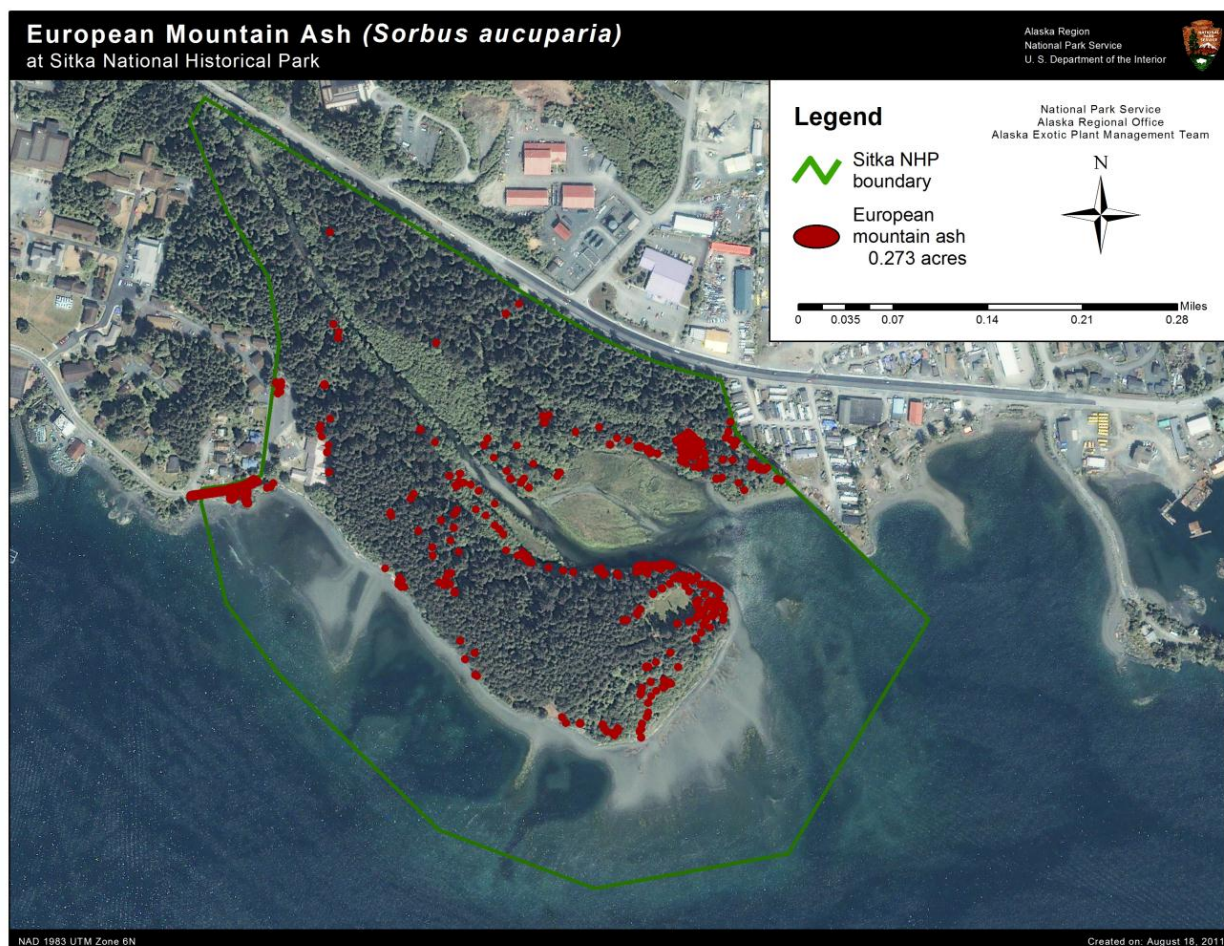




## Future Recommendations

### European Mountain-ash Management

European mountain-ash is prevalent throughout SITK (Figure 7), particularly along forest margins (roads, trails, coastline, and river edge) where light is more abundant. The species covers approximately 3 acres and grows in areas frequented by visitors, such as along trails and near the Russian Bishop's House, and in areas less visited, such as along the Indian River and above the intertidal zone. The trees range in size from small seedlings to large (>20 feet tall) trees. Trees damaged by wind, or other means, show extensive stump and root sprouting. Larger trees serve as hosts for lichen and moss species, provide berries for birds, and may be used by nesting birds and other animals. Little soil information is available for the park; however, it appears that European mountain-ash successfully grows in a wide range of soil types, including young beach soils, on tree trunks, and in more mature forest soils. The species grows within 5 meters of the upper intertidal zone (saltwater), the Indian River (freshwater), and its estuary (brackish water).



**Figure 7.** Map of European mountain-ash distribution throughout Sitka National Historical Park.

In Sitka, European mountain-ash has become well established along the coastal edge of the park's forest, to an extent that control needs to be accomplished gradually in order not to cause major disturbance both to the biological community and to visitor experience. Smaller trees could be manually controlled using a weed wrench to remove the upper roots. However, because mountain-ash resprouts when cut chainsaws alone will not accomplish effective control without incorporating herbicide use (Figure 8). The least environmental costs of control would be incurred through a cut-stump treatment, whereby herbicide is applied to the perimeter of freshly cut stems. Garlon 3A (active ingredient, Triclopyr), mixed with an equal portion of water, would be an appropriate herbicide for this application. Collaboration between SITK maintenance staff, EPMT staff, and SAGA crews would be required to successfully execute this effort. An in depth management will be completed during 2012.



**Figure 8.** European mountain-ash stump with re-sprouting vegetation.

### **Social Trail Management**

Currently in SITK there are main designated trails, accompanied by a network of numerous unofficial social trails used by local visitors to the park. The acquisition of five additional acres of land from Sheldon Jackson College in 2006 greatly increased the number of these unofficial trails within the park boundary. Efforts have been made to map the extent of these trails within SITK. The frequent use of these trails creates opportunities for invasive plant species to be spread to more remote areas of the park. Management of these trails and their future use is necessary to limit movement of invasive species through the park. Plans for trail restoration work are currently being developed. SITK EPMT should work with resource managers on the development of these plans.

### **Other Recommendations**

Various construction and maintenance projects are constantly being conducted throughout SITK. During the 2011 season a new totem pole was raised near the main Visitor Center entrance. This project included the creation of a graveled walkway and the planting of grasses, creating a large disturbance in a high traffic area. This area should be monitored in the coming years, as it has created a viable habitat for numerous invasive plant species.

Ethnobotanical gardens planted around the Visitor Center in 2005 have been left largely unattended. The disturbed, gravel filled beds create an ideal location for non-natives to establish. Currently a large concentration of high ranking invasive species, including oxeye daisy, curly dock, common sheep sorrel, and purple foxglove, are all growing in these gardens. These and other aggressive native species have led to a disorderly aesthetic throughout the gardens. Clear goals need to be developed regarding what the gardens should look like, how to achieve those goals, and who will maintain the gardens. EPMT should be involved in the development of these plans and aid in their execution by removing all present invasive plants and continuing to monitor the beds throughout future seasons.



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## Appendix A – List of known invasive plants within/near SITK

| Taxon  | Common Name           | Inside park? | Source of Observation <sup>1</sup> | Invasive Rank <sup>2</sup> |
|--|-----------------------|--------------|------------------------------------|----------------------------|
| <i>Capsella bursa-pastoris</i>                     | shepherd's purse      | Yes          | 2, 9                               | 40                         |
| <i>Centaurea montana</i>                           | perennial cornflower  | Yes          | 4, 5, 6, 7, 8, 9, 10               | 46                         |
| <i>Cerastium fontanum</i>                          | mouse-ear chickweed   | Yes          | 2, 4, 5, 6, 7, 8, 9, 10            | 36                         |
| <i>Cerastium tomentosum</i>                        | snow-in-summer        | Yes          | 5, 6, 7, 8, 9, 10                  | not ranked                 |
| <i>Chenopodium album</i>                           | lambsquarters         | Yes          | 2                                  | 37                         |
| <i>Digitalis purpurea</i>                          | purple foxglove       | Yes          | 1, 2, 3, 4, 5, 6, 9, 10            | 51                         |
| <i>Leucanthemum vulgare</i>                        | oxeye daisy           | Yes          | 1, 2, 3, 4, 6, 7, 8, 9, 10         | 61                         |
| <i>Linaria vulgaris</i>                            | yellow toadflax       | No           | 4                                  | 69                         |
| <i>Lychnis/Silene</i>                              | campion               | Yes          | 4                                  | not ranked                 |
| <i>Malus pumila</i>                                | apple                 | Yes          | 4, 5, 6, 7, 8, 9, 10               | not ranked                 |
| <i>Matricaria discoidea</i>                        | pineapple weed        | Yes          | 2, 3, 4, 6, 8, 9, 10               | 32                         |
| <i>Myosotis scorpioides</i>                        | forget-me-not         | Yes          | 4, 5, 6, 7, 8, 9, 10               | 54                         |
| <i>Phalaris arundinacea</i>                        | reed canarygrass      | No           | 4, 8, 9, 10                        | 83                         |
| <i>Phleum pratense</i>                             | common timothy        | Yes          | 2, 4, 8, 9, 10                     | 54                         |
| <i>Plantago major</i>                              | common plantain       | Yes          | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10      | 44                         |
| <i>Poa annua</i>                                   | annual bluegrass      | Yes          | 2, 8                               | 46                         |
| <i>Poa pratensis</i>                               | Kentucky bluegrass    | Yes          | 2, 8                               | 52                         |
| <i>Fallopia convolvulus</i>                        | black bindweed        | Yes          | 2, 8                               | 50                         |
| <i>Fallopia japonica</i>                           | Japanese knotweed     | Yes          | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10      | 87                         |
| <i>Prunus avium</i>                                | sweet cherry          | Yes          | 4, 5, 6, 7, 8, 9, 10               | not ranked                 |
| <i>Ranunculus acris</i>                            | tall buttercup        | Yes          | 10                                 | 54                         |
| <i>Ranunculus repens</i>                           | creeping buttercup    | Yes          | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10      | 54                         |
| <i>Rosa rugosa</i>                                 | rugosa rose           | Yes          | 5, 6, 7, 8, 9, 10                  | 72                         |
| <i>Rumex acetosella</i>                            | common sheep sorrel   | Yes          | 1, 4, 5, 6, 7, 8, 10               | 51                         |
| <i>Rumex crispus</i>                               | curly dock            | Yes          | 4, 8, 9, 10                        | 48                         |
| <i>Rumex obtusifolius</i>                          | bitter dock           | Yes          | 1, 10                              | 48                         |
| <i>Sagina procumbens</i>                           | birdseye pearlwort    | Yes          | 4, 8, 9, 10                        | 39                         |
| <i>Sorbus aucuparia</i>                            | European mountain-ash | Yes          | 2, 3, 4, 5, 6, 7, 8, 9, 10         | 59                         |
| <i>Taraxacum officinale</i> spp. <i>officinale</i> | common dandelion      | Yes          | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10      | 58                         |
| <i>Trifolium pratense</i>                          | red clover            | Yes          | 2, 4, 8, 9, 10                     | 53                         |
| <i>Trifolium repens</i>                            | white clover          | Yes          | 1, 3, 4, 5, 6, 7, 8, 10            | 59                         |
| <i>Sonchus arvensis</i>                            | perennial sow thistle | No           | 4                                  | 73                         |

<sup>1</sup> 1 = 2000 Invasive Plant Inventory

2 = 2002 AKNHP Vascular Plant Survey

3 = 2004 Invasive Plant Inventory

4 = 2005 Invasive Plant Inventory

5 = 2006 Invasive Plant Inventory

6 = 2007 Invasive Plant Inventory

7 = 2008 Invasive Plant Inventory

8 = 2009 Invasive Plant Inventory

9 = 2010 Invasive Plant Inventory

10 = 2011 Invasive Plant Inventory

<sup>2</sup> Alaska invasiveness ranking based on the threat to native ecosystems in Alaska from low (0) to high (100) (Carlson et al 2008).